<u>What is claimed is</u>:

1. A three-dimensional spectral imaging system comprising:

a source of collimated radiation disposed at a proximal side of an object; the collimated radiation having a predetermined wavelength;

a scanning angle changer operatively connected to at least one of the radiation source and the object;

a radiation detector disposed at a distal side of the object; and

a processor coupled to the radiation detector, the processor receiving information from the radiation detector and generating a three dimensional spectral image of the object based upon a principal component analysis of the received information.

2. The imaging system of claim 1, wherein the source of collimated radiation includes a light source and a monochrometer.

3. The imaging system of claim 2, wherein the source of collimated radiation further includes a collimator.

4. The imaging system of claim 3 wherein the collimator includes a polarizer.

5. The imaging system of claim 4, wherein the collimator further includes a quarter wave plate.

6. The imaging system of claim 3, wherein the collimator includes a set of baffles.

7. The imaging system of claim 3, wherein the collimator includes an array of fiber optic fibers.

8. A three-dimensional spectral imaging system comprising:

a source of collimated radiation disposed at a proximal side of an object, the collimated radiation having a predetermined wavelength;

a scanning angle changer operatively connected to at least one of the radiation source and the object;

a radiation detector disposed at a distal side of the object; and

a processor coupled to the radiation detector, the processor receiving information from the radiation detector and generating a three dimensional spectral image of a principal component of the received information.

9. The imaging system of claim 8, wherein the source of collimated radiation includes a light source and a monochrometer.

10. The imaging system of claim 9, wherein the source of collimated radiation further includes a collimator.

11. The imaging system of claim 10 wherein the collimator includes a polarizer.

12. The imaging system of claim 10, wherein the collimator further includes a quarter wave plate.

13. The imaging system of claim 10, wherein the collimator includes a set of baffles.

14. The imaging system of claim 10, wherein the collimator includes an array of fiber optic fibers.

15. A three-dimensional spectral imaging system comprising:

a source of collimated radiation disposed at a proximal side of an object, the collimated radiation having a predetermined wavelength between 1000 and 5000 nanometers;

a scanning angle changer operatively connected to at least one of the radiation source and the object;

a radiation detector disposed at a distal side of the object; and

a processor coupled to the radiation detector, the processor receiving information from the radiation detector and generating a three dimensional spectral image of the object.

16. The imaging system as recited in claim 15 further comprising an image display device for display of the three-dimensional image by the control computer.

17. The imaging system of claim 15, wherein the source of collimated radiation includes a light source and a monochrometer.

18. The imaging system of claim 17, wherein the source of collimated radiation further includes a collimator.

19. The imaging system of claim 18, wherein the collimator includes a polarizer.

20. The imaging system of claim 18, wherein the collimator further includes a quarter wave plate.

21. The imaging system of claim 18, wherein the collimator includes a set of baffles.

22. The imaging system of claim 18, wherein the collimator includes an array of fiber optic fibers.

23. A three-dimensional spectral imaging system for obtaining image information of an object, the system comprising:

a radiation source disposed at a proximal side of the object for passing a radiation beam having a predetermined wavelength through the object at a scanning angle;

a beam collimator disposed between the radiation source and the object;

a scanning angle changer operatively connected to at least one of the radiation source and the object;

a radiation detector disposed at a distal side of the object for detecting a plurality of two-dimensional spectral images of the object; and

a control computer for effecting operation of the radiation source, the radiation detector, and the scanning position changer, wherein the control computer enables the capturing the plurality of two-dimensional spectral images and is capable of determining a three-dimensional image of the object using the plurality of two-dimensional spectral images.

24. The imaging system as recited in claim 23 further comprising an image display device for display of the three-dimensional image by the control computer.

25. The imaging system as recited in claim 23 wherein the beam collimator includes a focusing lens.

26. The imaging system as recited in claim 23 further comprising a first set of optical elements disposed between the focusing lens and the object.

27. The imaging system as recited in claim 26 further comprising a second set of optical elements disposed between the object and the radiation detector.

28. The imaging system as recited in claim 27 wherein the first and second set of optical elements each include a polarizer.

29. The imaging system as recited in claim 27 wherein the first and second set of optical elements each include a quarter-wave plate.

30. The imaging system as recited in claim 23 wherein the control computer includes a data storage device for storing the plurality of two-dimensional spectral images.

31. The imaging system as recited in claim 23 wherein the radiation source includes a lamp and a monochrometer.

32. The imaging system as recited in claim 23 wherein the radiation beam is a near infrared radiation beam.

33. The imaging system as recited in claim 23 wherein the radiation beam is a mid-infrared radiation beam.

34. The imaging system as recited in claim 23 wherein the radiation source includes a wavelength filter for causing the radiation beam to have the predetermined wavelength.

35. The imaging system as recited claim 23 wherein the scanning angle changer includes a rotating stage.

36. The imaging system as recited in claim 23 wherein the scanning angle changer is capable of changing a position of the radiation source relative to the object.

37. The imaging system as recited in claim 23 further comprising a plurality of radiation sources disposed in a circular relationship relative to the object, and wherein the scanning angle changer is capable of operating the radiation sources individually to change a respective scanning angle between each of the plurality of radiation sources and the object.

38. The imaging system as recited in claim 23 wherein the radiation detector includes a CCD detector.

39. The imaging system as recited in claim 38 wherein the CCD detector includes a focal plane array camera.

40. The imaging system as recited in claim 39 wherein the focal plane array camera is an indium antimony liquid nitrogen cooled focal plane array camera.

41. The imaging system as recited in claim 23 further comprising software executable by the control computer, the software written in a MATLAB® programming language to perform the determining of the three-dimensional image.

42. The imaging system as recited in claim 23 wherein the control computer is capable of effecting operation of the radiation source, the radiation detector, and the scanning angle changer so as to change the predetermined wavelength of the radiation beam and the scanning angle changer and wherein each of the plurality of two-dimensional spectral images has a respective scanning angle and a respective wavelength.

43. The imaging system as recited in claim 42 wherein the control computer is capable of determining a spectral image data block by capturing at least two two-

dimensional spectral images at a same respective predetermined scanning angle and a different respective predetermined wavelength.

44. The imaging system as recited in claim 43 wherein the control computer is capable of compressing the spectral image data block.

45. The imaging system as recited in claim 43 wherein the control computer is capable of capturing the two-dimensional spectral images at a plurality of respective predetermined scanning angles so as to provide a 360 degree view of the object and so as to determine a plurality of respective spectral image data blocks.

46. The imaging system as recited in claim 45 wherein the control computer is capable of generating a respective RGB false color image from each of the plurality of respective spectral image data blocks.

47. The imaging system as recited in claim 46 wherein the control computer is capable of combining the generated RGB false color images to create a three-dimensional volume visualization package.

48. The imaging system as recited in claim 47 wherein the control computer is capable of determining the three-dimensional image of the object using the three-dimensional volume visualization package.

49. The imaging system as recited in claim 23 wherein the object is a solid pharmaceutical dose.

50. The imaging system as recited in claim 23 wherein the object includes a microsphere.

51. The imaging system as recited in claim 50 further comprising an encapsulation material surrounding the microsphere.

52. The imaging system as recited in claim 23 wherein the object includes a biological tissue.

53. The imaging system as recited in claim 23 wherein the object includes a transdermal patch.

54. A method for three-dimensional imaging of an object comprising the steps of:

a. directing a radiation beam having a predetermined wavelength from a radiation source through the object at a predetermined scanning angle;

b. collimating the radiation beam;

c. changing the predetermined wavelength;

d. changing the predetermined scanning angle;

e. capturing a plurality of two-dimensional spectral images of the object, each of the plurality of two-dimensional spectral images being captured at a respective scanning angle and a respective predetermined wavelength; and

f. reconstructing a three-dimensional image of the object using the plurality of two-dimensional spectral images.

55. The method as recited in claim 54 wherein the capturing is performed so as to capture at least two two-dimensional spectral images at a same respective predetermined scanning angle and at different respective predetermined wavelengths.

56. The method as recited in claim 54 wherein the capturing is performed so as to capture a plurality of two-dimensional spectral images at a same respective predetermined wavelength and at different respective predetermined scanning angles.

57. The method as recited in claim 54 wherein the changing of the scanning angle includes changing a relative position of one of the object and the radiation source.

58. The method as recited in claim 54 further comprising combining the plurality of two-dimensional spectral images to obtain image reconstruction data and wherein the reconstructing includes using the image reconstruction data.

59. The method as recited in claim 54 wherein the capturing is performed by detecting a portion of the radiation beam that has not been scattered after having passed through the object.

60. The method as recited in claim 54 further comprising storing the plurality of spectral images on a storage device.

61. The method as recited in claim 54 wherein the reconstructing is performed by using a control computer.

62. The method as recited in claim 61 wherein the directing of the radiation beam, the changing of the predetermined wavelength, the changing of the scanning angle, and the capturing of the plurality of two-dimensional spectral images are performed using the control computer according to a prescribed sequence.

63. The method as recited in claim 55 wherein the capturing of the at least two two-dimensional spectral images at a same respective predetermined scanning angle and at

different respective predetermined wavelengths is performed so as to determine a spectral image data block.

64. The method as recited in claim 63 further comprising compressing the spectral image data block.

65. The method as recited in claim 63 wherein the capturing is performed at a plurality of respective predetermined scanning angles so as to provide a 360 degree view of the object and so as to determine a plurality of respective spectral image data blocks.

66. The method as recited in claim 65 further comprising generating a respective RGB false color image from each of the plurality of respective spectral image data blocks.

67. The method as recited in claim 66 further comprising combining the generated RGB false color images to create a three-dimensional volume visualization package.

68. The method as recited in claim 67 wherein the reconstruction step is performed using the three-dimensional volume visualization package.

69. The method as recited in claim 54 further comprising displaying the three-dimensional image of the object on an image display.

70. The method as recited in claim 54 further comprising determining the predetermined wavelengths.

71. The method as recited in claim 54 further comprising filtering the radiation beam to project a monochromatic radiation beam from the radiation source onto the object.

72. The method as recited in claim 54 wherein the directing of the radiation beam includes passing the radiation through a first set of optical elements.

73. The method as recited in claim 72 wherein passing the radiation through a first set of optical elements further includes passing the radiation through a polarizer and a retardation plate.

74. The method as recited in claim 73 wherein passing the radiation through a polarizer and a retardation plate further comprises passing the radiation through a quarter-wave retardation plate.

75. The method as recited in claim 54 wherein the directing of the radiation beam includes passing the radiation beam through a second set of optical elements.

76. The method as recited in claim 75 wherein passing the radiation beam through a second set of optical elements includes passing the radiation through a polarizer.

77. The method as recited in claim 76 wherein passing the radiation through a second set of optical elements includes passing the radiation through a retardation plate.

78. The method as recited in claim 77 wherein passing the radiation through a retardation plate includes passing the radiation through a quarter-wave plate.

79. The method as recited in claim 54 wherein the capturing includes capturing the plurality of two-dimensional spectral images using a CCD detector.

80. The method as recited in claim 79 wherein capturing the spectral images using a CCD detector includes capturing the spectral images on a focal plane array camera.

81. The method as recited in claim 80 wherein capturing the spectral images on a focal plane array camera includes capturing the spectral images on an indium antimony liquid nitrogen cooled focal plane array camera.

82. The method as recited in claim 67 wherein the combining of the RGB images includes creating the three-dimensional visualization package using the inverse Radon transformation.

83. The method as recited in claim 64 wherein the compressing of the spectral image data block includes compressing using Principal Component Analysis.

84. The method as recited in claim 57 wherein the changing of the relative position includes rotating the object.

85. The method as recited in claim 57 wherein the changing of the relative position includes moving the near infrared radiation source in a circular trajectory.

86. The method as recited in claim 57 wherein the changing of the relative position includes positioning a plurality of near infrared radiation sources in a circular trajectory around the object and activating each of the plurality of sources in adjacent succession.

87. The method as recited in claim 54 wherein the object is a pharmaceutical dose.

88. The method as recited in claim 54 wherein the object is a biological tissue.

89. The method as recited in claim 54 wherein the object is a transdermal patch.

90. The method as recited in claim 54 wherein the reconstructing is performed using software written in a MATLAB® computing language.

91. The method as recited in claim 54 wherein the object includes a microsphere.

92. The method as recited in claim 54 further comprising an encapsulation material surrounding the microsphere.